Arizona's Children and the Environment

A Summary of the Primary Environmental Health Factors Affecting Arizona's Children

Arizona Department of Health Services
Bureau of Epidemiology and Disease Control
Office of Environmental Health
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Office of Environmental Health
150 N. 18th Avenue, Suite 430
Phoenix, Arizona 85007-3245
602-367-6412
1-800-367-6412

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Executive Summary

In accordance with the Governor's Children's Environmental Health Project initiative, the Arizona Department of Health Services, Office of Environmental Health, assessed the environmental factors that most affect Arizona's children. The purpose of this report is to inform the Arizona Department of Environmental Quality and other interested organizations and individuals of the results of our assessment and to request the collaboration of the Arizona Department of Environmental Quality in developing specific objectives and strategies for reducing children's exposure to ambient air pollutants and mercury in fish. New and updated objectives and strategies developed during the assessment and in collaboration with the Arizona Department of Environmental Quality for reducing the environmental exposures of children will be incorporated into the *Healthy Arizona 2010 Strategic Plan* [ADHS 2001a].

Background

Governor's Charge

Governor Janet Napolitano announced the start of the Children's Environmental Health Project - an initiative to reduce exposure of Arizona's children to environmental health hazards – in a ceremony at the State Capitol on April 11, 2003. The Governor stated that it was a priority of her administration to provide a clean and healthy environment for all Arizona citizens, particularly for its most sensitive and vulnerable ones - children.

The Governor charged the Arizona Department of Environmental Quality, in coordination with the Arizona Department of Health Services, to "bring focus to the environmental challenges affecting the health of Arizona's children". The Governor also directed the Arizona Department of Environmental Quality to lead the project and to develop and use a four-step C.A.R.E. strategy to focus on the challenges and to assess and reduce the exposure of children to environmental hazards in Arizona. The Governor defined the C.A.R.E. strategy as:

- Coordinate individuals, groups, academia, and government involved in children's environmental health issues, initially focusing on air quality and asthma.
- Assess and prioritize the environmental health factors affecting Arizona's children.
- Reduce the number and types of contaminants adversely affecting children.
- Educate citizens about environmental hazards and how to reduce children's exposure.

Initial Focus on Air Quality and Asthma

The Governor spoke at length about asthma in her speech on April 11, 2003, stating that it was unacceptable that the prevalence and mortality rates for asthma in Arizona have exceeded the national average in 9 out of the last 10 years. She directed the Arizona Department of Environmental Quality to implement the C.A.R.E. strategy with an initial focus on air quality and asthma.

Arizona Children's Environmental Health Forum

On May 30, 2003, the Arizona Department of Environmental Quality hosted the Arizona Children's Environmental Health Forum - the first step in the Arizona Children's Environmental Health Project. Governor Napolitano delivered the keynote address in which she again outlined Arizona's C.A.R.E. strategy for the Children's Environmental Health Project. The Forum featured presentations by prominent experts in the areas of children's health and the environment and an afternoon discussion session among participants from throughout Arizona. Steve Owens, Director of the Arizona Department of Environmental Quality, and Cathy Eden, Director of the Arizona Department of Health Services, made opening remarks.

In her opening remarks, Dr. Eden stated that the Governor had asked the Directors of both the Arizona Department of Environmental Quality and the Arizona Department of Health Services to develop specific actions which could be implemented to improve the environmental factors that affect Arizona's children. Dr. Eden outlined the process as follows: "We will assess and prioritize the environmental factors that affect Arizona's children. Then comes the important part, developing specific strategies to reduce the types and amounts of contaminants that adversely affect the health of Arizona's children."

Office of Environmental Health Assessment

Following on the Governor's charge, and the path outlined by Dr. Eden, the Arizona Department of Health Services, Office of Environmental Health, assessed the environmental exposures facing Arizona's children. Our assessment included an evaluation of the:

- *Healthy Arizona 2010 Strategic Plan* [ADHS 2001a];
- Healthy People 2010 Objectives [DHHS 2000];
- *Arizona Comparative Environmental Risk Project* reports [ACERP 1995]; and
- Websites and publications of other agencies, organizations, and individuals.

The results of our assessment to identify the environmental exposures that significantly affect the health of Arizona's children are shown in the table below.

Environmental Exposures Significantly Affecting Children In Arizona

Ambient Air Pollutants and Asthma
Allergens and Asthma
Secondhand Tobacco Smoke and Asthma
Coccidioidomycosis (Valley Fever)
Lead Poisoning
Sun Exposure
Methylmercury in Fish
Pesticide Exposure

Healthy Arizona 2010 Strategic Plan

The *Healthy Arizona 2010 Strategic Plan* is an existing vehicle that can be used by agencies and other participants to identify and address the most important health problems of Arizona's children [ADHS 2001a]. The *Healthy Arizona 2010 Strategic Plan* is based on Healthy People 2010, which is a set of health objectives for the nation to achieve over the first decade of the 21st century. The 10 Leading Health Indicators (LHI) and 467 science-based objectives of *Healthy People 2010* were developed by federal agencies with the most relevant scientific expertise informed by the Healthy People Consortium-an alliance of more than 350 national organizations and 250 state health and environmental agencies. Additionally, more than 11,000 public comments on the draft objectives were received.

The *Healthy Arizona 2010 Strategic Plan,* completed by the Arizona Department of Health Services in March 2001, is a comprehensive statewide strategic plan for improving the health of all Arizonans over the next decade. The plan is coordinated through the Arizona Department of Health Services as a statewide initiative and incorporates the participation of county and tribal health departments, border communities, cities and towns, the faith community, schools and colleges, voluntary organizations, businesses, and others. Adopting the ten Leading Health Indicators of the national plan and adding two more indicators, the state plan contains twelve focus areas and 52 objectives developed and agreed upon by statewide planning teams composed of agency and community representatives.

The twelve focus areas of *Healthy Arizona 2010 Strategic Plan* are:

1.	Physical Activity	7.	Injury & Violence Prevention
2.	Nutrition	**8.**	**Environmental Health**
3.	Tobacco Use	9.	Immunization & Infectious Disease
4.	Substance Abuse	10.	Access to Care
5.	Responsible Sexual Behavior	11.	Maternal/Infant Health
6.	Mental Health	12.	Oral Health

Plan Revision

Attached is additional information on the environmental exposures significantly affecting children in Arizona (listed in the table above), as well as existing and proposed new objectives and strategies for reducing these exposures. The Appendix to the report presents information on the health issues of children living in the United States-Mexico border region. The Office of Environmental Health will revise the **Environmental Health Focus Area** of the *Healthy Arizona 2010 Strategic Plan* to include the new and updated objectives and strategies. In addition, the Office of Environmental Health requests the collaboration of the Arizona Department of Environmental Quality in developing specific objectives and strategies to reduce the exposure of children to ambient air pollutants and methylmercury in fish.

To improve the lives of children we would also choose to reduce poverty, violence, and alcohol abuse. All have serious harmful effects on children's lives; however, none of these are what we think of as environmental pollution. The fact that this paper does not focus on poverty, alcohol abuse, and violence does not imply they are unimportant.

Ambient Air Pollutants and Asthma

Health Concerns

For reasons not well understood, asthma among children has more than doubled in America over the past 20 years. Asthma is a priority for attention because it is the most common chronic disease in children, and because it has been steadily increasing in the United States. Nationally, asthma affects more than 20 million people including six million children. The most rapid increase has occurred in children under 5 years old with rates increasing 160% over the past 15 years. In the year 2000, nearly 1 in 13 or approximately 8% of school-aged children in the United States had asthma. Poor and minority children are disproportionately affected by asthma, which has reached epidemic proportions in many American inner cities [PTF 2000].

The number of hospitalization and emergency room visits for asthma has increased in all population groups. Asthma accounts for one-third of all pediatric emergency room visits and is the fourth most common cause for physician office visits. African-American children have an annual hospitalization rate for asthma over 3 times that of white children and are approximately 4 times more likely than white children to seek care for asthma at an emergency room. [PTF 2000]. Asthma symptoms that are not severe enough to require a visit to an emergency room or to a physician can still be severe enough to prevent a child from living a fully active life. For instance, asthma is one of the leading causes of school absenteeism, accounting for an estimated 14 million school days missed each year [PTF 2003].

The number of deaths attributed to asthma in children has also increased. Although the death rate due to asthma has increased in all racial and ethnic groups, minority populations experience a disproportionately higher death rate from asthma. Indeed, African-American children are four times more likely to die from asthma than white children [PTF 2000; NRDC 2003].

Asthma is also the most frequent chronic disease of childhood in Arizona. Children's asthma rates are higher in Arizona than in most states, but the reasons for this are not known. Dr. Fernando Martinez of the Arizona Respiratory Center of the University of Arizona estimates that anywhere between 12% and 25% of Arizona children have the disease depending on how asthma is defined [Martinez 2003]. It has been suggested that asthma rates are higher in Arizona because people with asthma (and thus with "asthma genes") have chosen to move here in the hope their asthma will get better. They may also pass the "asthma genes" down through generations [Martinez 2003].

It is not known what causes the onset of asthma, but it appears that asthma is the result of complex interactions between genes and the environment with both playing approximately equal roles. Because asthma triggers are better understood than causes of development of asthma, much of the focus is on the reduction of exposure to triggers. Outdoor air pollutants and biological agents contribute to asthma. Outdoor air pollutants that are known to trigger asthma episodes are ozone and particulate matter and possibly sulfur dioxide and hazardous air

pollutants. Biological agents of concern include pollen and mold. Indoor environmental factors known to trigger episodes and/or contribute to the development of asthma are allergens produced by dust mites, cockroaches, molds, and animal dander, and irritants such as secondhand tobacco smoke, industrial chemicals, perfume, and fumes from paint and gasoline.

Outdoor Air Pollutants

Children with asthma have long been recognized as particularly sensitive to outdoor air pollution. There is unmistakable evidence that asthma episodes in children are triggered by exposure to ozone and particulate matter and may also be triggered by exposure to sulfur dioxide and hazardous air pollutants [Martinez 2003; PTF 2000]. Air pollution may also act synergistically with other environmental factors to worsen asthma. For example, some evidence suggests that exposure to ozone can increase a person's responsiveness to inhaled allergens.

Diesel Exhaust Exposure from School Buses

Diesel exhaust is a complex mixture comprised of hazardous particles and vapors. Diesel exhaust is classified as a probable human carcinogen by many governmental authorities, including the U.S. Environmental Protection Agency, World Health Organization, and the U.S. National Toxicology Program. It is classified as a known carcinogen by the State of California. The California South Coast Air Quality Management District recently estimated that nearly 71% of the cancer risk from air pollutants in the area is associated with diesel emissions. Diesel exhaust includes benzene, 1,3-butadiene, and soot - all classified as known human carcinogens [EHHI 2003]. In addition to its carcinogenic properties, diesel exhaust currently includes over 40 substances that are listed by the U.S. Environmental Protection Agency as hazardous air pollutants (HAPs) and by the State of California as Toxic Air Contaminants (TACs) [CALEPA 2003a].

Children may be especially susceptible to adverse respiratory effects of exposure to fine-diameter particulate matter ($PM_{2.5}$) emitted from diesel engines. Nearly 94% of diesel particulates have diameters less than 2.5 microns. The average diameter of diesel particulates is 0.2 microns. Smaller particles are able to penetrate children's narrower airways reaching deeply into the lung [EHHI 2003]. Fine particles from diesel exhaust aggravate respiratory illness such as asthma and bronchitis. Recent research indicates that diesel exhaust may increase the frequency and severity of asthma episodes and may lead to inflammation of the airways that can cause or worsen asthma [NRDC 2003]. In announcing new standards for diesel engines and fuels in 2000, the U.S. Environmental Protection Agency stated that the new standards would prevent over 17,600 cases of acute bronchitis, 360,000 asthma episodes, and more than 386,000 cases of respiratory symptoms in asthmatic children annually [CHEC 2003].

The U.S. Environmental Protection Agency has established the Clean School Bus USA program to reduce both children's exposure to diesel exhaust and the amount of air pollution created by diesel school buses [EPA 2003a].The vast majority of school buses in the United States are powered by diesel fuel. Each day, nearly 600,000 school buses transport 24 million students to schools in the United States. The time spent on buses by individual students varies between 20 minutes and several hours per day. For one child, a half-hour ride to school, and a half-hour ride home each day amounts to 180 hours per school year. [EHHI 2003]. Diesel exhaust from

queued and idling school buses can accumulate on and around the buses and pose a health risk. When buses idle in the schoolyard, the exhaust can pollute the air inside the school. Studies conducted by the California Air Resources Board found that children were also exposed to significantly higher diesel emissions during the school bus commute. The causes of these higher exposures were: 1) the high concentrations of pollutants already present on roadways; 2) the direct influence of vehicles immediately in front of the bus; and 3) the contribution of the buses own emissions. Diesel particulate matter was consistently several times higher inside conventional diesel buses compared to compressed natural gas (CNG) buses or a particle trap-equipped bus [CALEPA 2003a].

Arizona Ozone and Particulate Nonattainment Areas

Many children live in parts of Arizona where outdoor air pollution exceeds federal standards. Areas with air quality not meeting the standards are designated by the U.S. Environmental Protection Agency as "nonattainment areas." Once an area has been designated as a nonattainment area, a State Implementation Plan (SIP) revision must be developed and submitted to the U.S. Environmental Protection Agency. The State Implementation Plan demonstrates to the U.S. Environmental Protection Agency the reduction measures to be undertaken in the area to reduce the pollutant levels to meet the air quality standards.

Areas of Arizona currently not meeting particulate (PM_{10}) standards are listed below. All are moderate PM_{10} nonattainment areas except the Phoenix Area which is a serious PM_{10} nonattainment area. The Phoenix Area is also a serious nonattainment area for ozone – the only nonattainment area in the State for ozone.

Ajo Area, Pima County
Bullhead City Area, Mohave County
Douglas Area, Cochise County
Hayden Area, Gila and Pinal County
Nogales Area, Santa Cruz County
Paul Spur Area, Pima County
Payson Area, Gila County
Phoenix Area, Maricopa County
Rillito Area, Pima County
Yuma Area, Yuma County

Hazardous Air Pollutants

To date, little research has examined the role of hazardous air pollutants (HAPS) in the development or exacerbation of asthma, although this is an issue of increasing public concern. Because adult-onset asthma is known to be associated with occupational and home-based exposure to volatile organic compounds (VOC's), formaldehyde, ethylene oxide, and isocyanates, further work to assess the possible role of specific hazardous air pollutants in childhood asthma is appropriate [PTF 2000]. In California, the Children's Environmental Health Protection Act (Senate bill 25) enacted in 1999 directed the California Environmental Protection Agency to establish a list of up to 5 specific toxic air contaminants that could cause infants and children to be especially susceptible to illness. The California Air Resources Board is required to revise control measures for these 5 toxic air contaminants to reduce exposure [CALEPA 2003b]. The California Environmental Protection Agency released its final report on the toxic air contaminant selection process, entitled Prioritization of Toxic Air Contaminants Under the Children's Environmental Health Protection Act, in October 2001 [CALEPA 2003b].

Objectives and Strategies

Reducing exposure to ambient air pollutants will reduce the frequency and severity of asthma episodes in children, reduce their need for medicine, and improve their lung function.

Objective #1: Ensure that ambient air in Arizona achieves U.S. Environmental Protection Agency attainment status for criteria air pollutants by 2010. This specifically includes particulate matter and ozone. ***(Existing)***

Strategy #1: Implement all current federally-mandated ozone and particulate matter control measures. *(Existing)*

Strategy #2: Implement all recommendations of the 2000 Brown Cloud Summit Task Force *(Existing)*

Objective #2: Reduce the exposure of Arizona children to diesel emissions from school buses. ***(Proposed)***

Objective #3: Reduce the exposure of Arizona children to selected hazardous air pollutants. ***(Proposed)***

Objective #4: Provide information to the public about asthma and the specific objectives and strategies adopted by the State to reduce asthma episodes in Arizona children. This objective is to be accomplished through public outreach including the development of website information and written materials. ***(Proposed)***

Allergens and Asthma

Health Concerns

Allergies and asthma often go hand in hand. Allergies are a leading trigger for asthma episodes. The American Lung Association states that approximately 75 to 80 percent of children with asthma have significant allergies [ALA 2003b]. Asthma may be triggered by allergens and irritants that are common in homes or by outside sources such as molds and pollen. Allergens are substances that cause no problem for a majority of people, but for reasons not understood, the immune systems of certain people mistakenly react to a harmless substance as though it were dangerous. When that happens, the person is said to have an allergy. During an allergy attack, the body releases chemicals called mediators. These mediators often trigger asthma episodes [EPA 2003b].

Indoor Allergens and Irritants

Since Americans spend up to 90% of their time indoors, exposure to indoor allergens and irritants may play a significant role in triggering asthma episodes. House dust mites, cockroaches, mold, and animal dander have been identified as important indoor allergens that trigger asthma symptoms. Allergens not only act as asthma triggers but exposures to high levels of allergens in the indoor environment have been shown in some studies to be associated with the development of asthma as well [PTF 2000]. Almost any food can trigger an allergy, although eight categories of food account for 90 percent of all reactions: milk; eggs; peanuts; tree nuts; finfish; shellfish; soy; and wheat [Adler 2003].

Irritants such as cold air, cigarette smoke, industrial chemicals, perfume, and fumes from paint and gasoline can trigger asthma episodes. These irritants probably trigger asthma symptoms by stimulating irritant receptors in the respiratory tract. These receptors, in turn, cause the muscles surrounding the airway to constrict, resulting in an asthma episode. Upper respiratory viral infections are recognized as an important trigger for acute asthma episodes. Surprisingly, bacterial infections, with the exception of sinusitis, generally do not bring about asthma episodes. Environmental tobacco smoke is an important irritant that can trigger asthma episodes and possibly worsen the effects of allergens [EPA 2003b].

Outdoor Allergens

Pollen

Exposure to outdoor allergens (pollens, and molds) are associated with increased asthma symptoms and an increased risk of emergency room visits for asthma [PTF 2000]. Central and Southern Arizona have growing seasons more than 10 months long, allowing a proliferation of pollens from trees, grasses and other plants to be dispersed. Also, the diverse flora of the Sonoran desert has been further increased by the introduction in urban areas of a large number of species from other regions of North America and the world. Airborne pollen allergens in the Southwest are mainly, but not exclusively, from these introduced species [UA 2002].

Plants with attractive, brightly colored flowers that are pollinated only by insects (e.g. roses) rarely cause allergy. One exception in the Southwest is the Palo Verde tree which causes allergy

even though its brightly colored yellow flowers attract bees. This tree has such a large number of blooms that considerable amounts of excess pollen are released into the air. Wind-pollinated plants produce comparatively huge quantities of pollen that can travel 20 miles or more on a windy day. Bermuda grass, an introduced species, produces the most important allergenic pollen that is known to cause asthma episodes. One of the allergenic weeds in Southern Arizona, Triangle-leaf Bursage, is a ragweed that flowers in the spring. Fortunately, airborne ragweed pollen counts in the Southwest do not reach the enormous levels often recorded in the Midwest and East [UA 2003a]. Hay fever, or "seasonal allergic rhinitis," an annoying sensitivity to tree, grass, or ragweed pollen, has increased remarkably just since 1996 – from 6 percent of American children 18 and under to 9 percent, according to the National Center for Health Statistics. In fact, all allergies seem to be on the rise and the severity of those allergies has increased as well. The University of Arizona Health Sciences Center provides information on asthma, allergies, and allergic plant species in the southwestern United States [UA 2003b].

Mold

Mold spores are much smaller than pollen grains, allowing many of them to effectively bypass the normal filtering function of the nose. Inhalation of mold spores into the lung is a common cause of asthma episodes in people allergic to molds. Mold spores come from soil and decaying vegetation, and are ubiquitous. Mold counts increase near irrigated farm land, golf courses, artificial lakes and high water use vegetation. In the semi-arid Southwest, atmospheric mold spore counts are much lower than in regions that have a higher rainfall. Mold growth and spore counts increase with increased rainfall and high humidity, while dry and cold conditions tend to inhibit mold growth. Mold can be a problem in houses with evaporative cooling and/or old carpets and can increase after a plumbing or roof leak. The most common types of mold in the Southwest include *Alternaria, Cladosporium,* and *Helminthosporium* [UA 2003c]

Objectives and Strategies

Objective #1: Reduce the incidence of allergenic-asthma in Arizona children. ***(Proposed)***

Strategy #1: Inform the public about allergens and allergies and their contribution to asthma through public outreach including the development of website information and written materials. *(Proposed)*

Secondhand Tobacco Smoke and Asthma

Health Concerns

Secondhand tobacco smoke is a serious health risk to children. Secondhand smoke contains several hundred recognized toxic substances, including numerous carcinogens. The U.S. Environmental Protection Agency has classified secondhand smoke as a known cause of cancer in humans. Children whose parents smoke are among the most seriously affected by exposure to secondhand smoke, being at increased risk of lower respiratory tract infections such as pneumonia and bronchitis. The U.S. Environmental Protection Agency estimates that secondhand tobacco smoke is responsible for between 150,000 and 300,000 lower respiratory tract infections in infants and children under 18 months of age annually, resulting in between 7,500 and 15,000 hospitalizations per year [EPA 2003c].

The U.S. Environmental Protection Agency estimates that exposure to secondhand smoke increases the number of episodes and severity of symptoms in hundreds of thousands of asthmatic children. Exposure to secondhand smoke is also a risk factor for the development of asthma in thousands of children each year. Children exposed to secondhand smoke are also more likely to have reduced lung function and symptoms of respiratory irritation like cough, excess phlegm, and sneezing. Passive smoking can lead to a buildup of fluid in the middle ear, the most common cause of hospitalization of children who need an operation. Asthmatic children are especially at risk. Secondhand smoke may also increase the risk for sudden infant death syndrome (SIDS) [EPA 2003c].

Nationally, the percentage of homes with children under 7 in which someone smokes on a regular basis decreased from 29% in 1994 to 19% in 1999. The American Lung Association reports that in Arizona for year 2000, 18.6% of adults aged 18 and older, 7.4% of expectant mothers (1999), and 11.4% of youth in grades 6-8 smoked cigarettes. (Data is not available for grades 9-12) [ALA 2003a]. Arizona has one of the lowest adult smoking rates of any of the states. The greatest challenge that remains in Arizona is the reduction of tobacco use among adolescents whose rates tend to be higher in Arizona than in the rest of the nation.

Objectives and Strategies (Environmental Health Focus Area)

Objective #1: Improve indoor air quality in Arizona by eliminating environmental tobacco smoke in 100% of public buildings and 80% of semipublic buildings by 2010 ***(Existing)***

Strategy #1: Promote public policy to implement prohibitions on smoking in public and semipublic buildings in Arizona municipalities. *(Existing)*

Objective #2: Reduce the exposure of Arizona children to secondhand smoke in private homes. ***(Proposed)***

Strategy #1: Inform the public of the health hazards of secondhand smoke and its contribution to asthma through public outreach including the development of website information and written materials *(Proposed)*

Objectives and Strategies (Tobacco Use Focus Area)

The objectives and strategies in the Tobacco Use Focus Area of the *Healthy Arizona 2010 Strategic Plan* indirectly support the reduction of exposure of children to secondhand smoke.

Objective #1: **Reduce tobacco use by youth in 6th – 8th grades. *(Existing)***

Strategy #1: Build and maintain the Arizona Department of Health Services capacity to effectively and efficiently administer a statewide tobacco control program (TEPP). *(Existing)*

Strategy #2: Develop and support community-based tobacco control programs which provide comprehensive services (i.e. Local Projects). *(Existing)*

Strategy #3: Establish a statewide tobacco control clearinghouse which can provide information, referrals, educational materials, technical assistance, and training (i.e. ATIN). *(Existing)*

Strategy #4: Establish a statewide mass media campaign which promotes comprehensive tobacco control using television, radio, print, outdoor, and other appropriate media. *(Existing)*

Objective #2: **Reduce tobacco use by youth in 9th – 12th grades. *(Existing)***

Same strategies as Objective #1, plus:

Strategy #5: Establish a statewide toll-free telephone help line for information, materials, referrals, and assistance with tobacco dependence (i.e. ATIN, ASHline). Objective #2 only. *(Existing)*

Objective #3: **Reduce tobacco use by adults. *(Existing)***

Same strategies as Objective #1.

Coccidioidomycosis (Valley Fever)

Health Concerns

Indigenous to the desert soil in the southwestern United States and northwestern Mexico is a fungus called *Coccidioides immitis*, or "cocci." Cocci grow in soils in areas of low rainfall, high summer temperatures, and moderate winter temperatures. It is not found in agricultural soils above 4,000 feet in altitude. Being a form of plant life, the organism proliferates in the soil when it rains. Once moisture percolates below the surface, the top layer of desert soil becomes rich with the fungus.

The cocci spores attach to dust particles which become airborne when the soil is disturbed by winds (dust storms), construction, farming, and recreational activities such as driving ATVs or 4-wheel drive vehicles in the desert. When inhaled into the lungs, the spores cause an infection in susceptible people known as Valley Fever. Valley Fever is prevalent in the San Joaquin and Central Valleys of California, in the hot desert regions of southern Arizona (especially in the Phoenix and Tucson areas), southern Nevada, southern Utah, southern New Mexico, western Texas around El Paso, and in the Mexican States of Sonora and Chihuahua [VFCE 2003a].

Valley fever is primarily a disease of the lungs. Most cases (60%) have no symptoms or only very mild flu-like symptoms; however, Valley Fever can be a serious illness. When symptoms are present, the most common are fever, cough, fatigue, rash, profuse sweating at night, loss of appetite, chest pain, and muscle and joint aches [VFCE 2003b]. It can also present as an acute, chronic, or disseminated (affecting meninges, skin, and bones) form of pneumonia [CDC 2002].

In Arizona, it is estimated that each year 3% of the resident population will contract Valley Fever [VFCE 2003b]. Thousands of these will be children who will develop subclinical infections of which hundreds will develop clinical infections. Serious illness can occur in children with impaired immune systems. Table 1 shows the rate and number of reported cases of Valley Fever in children in 2001 [ADHS 2002].

Table 1. Number of Reported Cases of Valley Fever for Children per 100,000 Population, Arizona, 2001

Age Group	Rate	Number of Children Affected in 2001
<5	3.1/100,000	12
5 – 9	5.1/100,000	20
10 – 15	13/100,000	50
15 – 19	21.8/100,000	80

In 2001, seventy-five percent of cases (both adult and children) occurred in Maricopa County (54 per 100,000), exceeding the rates for Pinal and Pima Counties for the first time in 10 years (Table 2).

Table 2. Number of Reported Cases of Valley Fever per 100,000 Population by County of Residence, Arizona, 2001

Maricopa	54	Graham	15	Santa Cruz	5
Pima	47	Mohave	15	Navajo	5
Pinal	45	Greenlee	12	Yavapai	5
La Paz	35	Coconino	8	Cochise	3
Gila	25	Yuma	7	Apache	2

Reports of coccidioidomycosis are increasing in Arizona. Immigration of susceptible residents, a growing immunosuppressed population, changing climatic conditions affecting *Coccidioides immitis* growth and sporulation, construction/development of previously undisturbed desert lands, and better reporting may all be contributing to the increase in reported cases.

Objectives and Strategies

Objective #1: Reduce the incidence of coccidioidomycosis in Arizona children. ***(Proposed)***

Strategy #1: Inform the public about the health hazards of coccidioidomycosis through public outreach including the development of website information and written materials. *(Proposed)*

Lead Poisoning

Health Concerns

Since lead was phased out of gasoline in the early 1980s, and from paint in 1978, the average amount of lead in people's blood in the United States has plummeted from approximately 16 micrograms per deciliter (ug/dL) to less than 3 ug/dL by 1990. But lead poisoning still occurs and the bulk of research shows there is not a specific threshold below which lead is known to be safe [Moore 2003].

Childhood lead poisoning is a significant environmental health problem, yet it is entirely preventable. Lead has adverse effects on nearly all organ systems of the body but is especially harmful to the developing brains and nervous systems of children under the age of 6 years. At very high blood lead levels (≥70 ug/dL), children can suffer seizures, coma, severe brain damage, or death. Other symptoms of lead poisoning are: lack of appetite; vomiting; fatigue; anemia; and abdominal pain. At blood lead levels as low as 10 micrograms per deciliter (ug/dL), children's intelligence, hearing, and growth are affected. (A number of studies have estimated that a child's IQ will drop by one to three points for every increase of 10 ug/dL in the child's blood lead level.) This damage can be stopped if a child's lead exposure is reduced, but it is not known if the damage can be reversed – studies are ongoing in this area. Research has also shown a link between lead exposure and children's behavioral problems such as inattention, restlessness, and aggression [Moore 2003]. The presence of lead-poisoned children in a community can be associated with an increase in the number of children with developmental deficits and learning disorders. This places an unnecessary and expensive burden on the educational system and requires substantial community public health resources for medical and environmental case management [ADHS 2001b, 2003a].

Currently, a child is considered to be physiologically lead-poisoned at a blood lead level equal to 10 ug/dL or greater – the "level of concern" established by the Centers of Disease Control and Prevention in 1991. However, new research by two Cornell University scientists published in the *New England Journal of Medicine* suggests not only that lower levels of lead may affect intelligence but that most of the damage to intellectual functioning occurs at blood lead concentrations below 10 ug/dL. The researchers are to discuss their data with the Centers for Disease Control and Prevention [Canfield et. al. 2003].

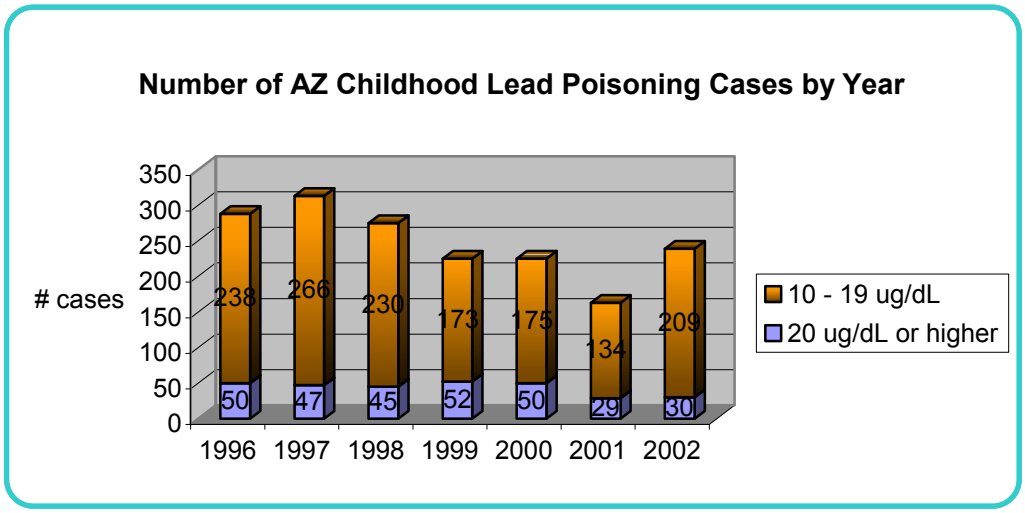
Lead Poisoning Cases in Arizona

Laboratories and health care providers reported 239 children in Arizona with lead poisoning (≥10 ug/dL) in 2002. Eighty-seven percent (87%), or 209 of the 239 childhood cases, were in the lower range of lead poisoning (10 to <20 ug/dL). The remaining 30 cases (13%) were in the moderate to severe range of lead poisoning (≥20 ug/dL) [ADHS 2003b].

Approximately 77% of the 239 childhood lead poisoning cases in 2002 were Hispanic. It is not known whether the disproportionate number of Hispanic cases was the result of socioeconomic factors, sampling bias, a random effect, or some unidentified risk factor. The over-representation

of Hispanic children persisted in the group of children reported to have blood levels ≥ 20 ug/dL [ADHS 2003b].

Figure 1. Number of Arizona Childhood Lead Poisoning Cases (1996-2002)



Exposure

Ingestion of lead through hand-to-mouth behavior is the primary pathway of exposure. Inhalation is another exposure pathway. Children between the ages of 12 – 36 months are most vulnerable to lead poisoning because: 1) They ingest more lead due to hand-to-mouth behavior; 2) Their gastrointestinal tracts absorb more lead than adults; and 3) Their developing central nervous systems are more sensitive to the effects of lead poisoning. Nutrient deficiencies of iron, calcium, vitamin C, and protein increase the vulnerability to lead poisoning and its adverse effects [ADHS 2001c].

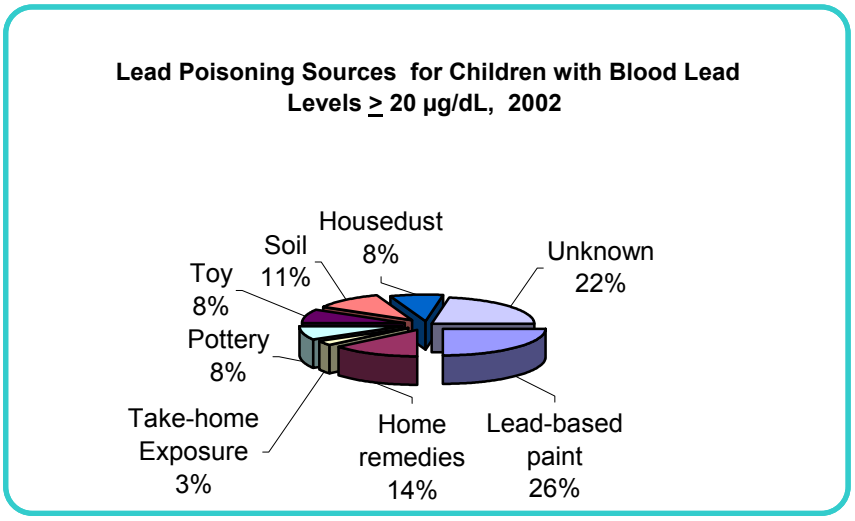
Sources of lead exposure include [ADHS 2001d]:

- Lead-based paint, if the paint is deteriorating or disturbed
- Household dust that contains residues from lead-based paint
- Lead-contaminated soil
- Water
- Imported pottery used for cooking and storing food
- Folk remedies containing lead
- Some imported crayons, toys, and lead toy soldiers
- Some imported vinyl mini-blinds and vertical blinds
- Mines, smelters, brass/copper foundries
- Firing ranges, bullets, fishing weights, sinkers
- Automotive radiator repair and automotive batteries
- Stained glass making and ceramics
- Occupational take-home exposure; adults who bring lead dust home on their clothes

Lead-based paint in homes and household dust that contains residues from lead-based paint are the most important sources of exposure, according to the Arizona Department of Health Services registry and national data. The older the house, the more likely it is to contain lead-based paint. In Arizona, approximately 64% of all homes were built before 1978, the year lead-based paint was banned. Almost 7% of Arizona housing was built prior to 1950, when the concentration of lead in paint was higher. Some neighborhoods have more than 75% pre-1950 homes and, therefore, children in these areas are at greater risk for lead poisoning. The Arizona Department of Health Services and the Childhood Lead Poisoning Screening Coalition have developed a Childhood Lead Poisoning Targeted Screening Plan that identifies the areas in Arizona that have a higher risk for lead poisoning [ADHS 2001e; 2003a].

Lead-containing home remedies and imported pottery are common sources of lead exposure in Arizona. Some members of the Hispanic community use "azarcon," an orange lead oxide powder or "greta," a yellow lead oxide powder, for *empacho*, or digestive ailments. Clay pottery made in Mexico usually contains high amounts of lead in the glaze and paint. The pottery is used for cooking and storing beverages, and is sold in retail stores in Arizona and in Mexico. The pottery and folk remedies have been implicated in cases involving blood lead levels as high as 60 ug/dL [ADHS 2001e; 2003a].

Figure 1. Lead Poisoning Sources for Children with Blood Lead Levels ≥ 20 ug/dL or with Persistent Blood Lead Levels of 15 to 19 ug/dL (2002)



Objectives and Strategies

Objective #1: Eliminate child lead poisoning (≥10 ug/dL) in Arizona by 2010. ***(Proposed)***

Strategy #1: Develop Elimination Plan. (*Proposed*)

Objective #2: Implement Targeted Screening Plan. ***(Proposed)***

Strategy #1: All children living in targeted ZIP codes should have a blood lead test at 12 and 24 months of age. Children aged 36 to 72 months should be tested if they have not been previously tested. *(Proposed)*

Strategy #2: All children covered by the Arizona Health Care Cost Containment System (AHCCCS) should be tested according to the Centers for Medicare and Medicaid Services (CMS) requirements, as follows: test all children at 12 and 24 months of age; test children at 36 to 72 months of age if they have not been previously tested. *(Proposed)*

Strategy #3: For children not living in a targeted ZIP code area, health care providers should conduct an individual risk evaluation in order to determine whether those children are at increased risk of having an elevated blood lead level (BLL). *(Proposed)*

Objective #3: Implement an effective media campaign to prevent lead poisonings. ***(Proposed)***

Excessive Sun Exposure

Health Concerns

Skin cancers represent half of all new cancers in the United States and are the most common of all cancers in the United States. One in five Americans develops skin cancer in their lifetime. Melanoma, the most deadly of all skin cancers, is increasing faster than any other preventable cancer in the United States. In Arizona, the number of melanoma cases has risen 55 percent since 1997. The incidence rate of skin cancer in male Caucasians in the United States is 14 per 100,000 population, but in Arizona it is 38 per 100,000 [ADHS 2003c]. Those who live in Arizona develop potentially deadly skin cancer twice as often as people in other states and are second only to Australians in the rate of skin cancer.

Sunburn and overexposure to ultraviolet radiation are the primary causes of skin cancer, including the deadliest form melanoma. Eighty percent of a person's lifetime sun exposure occurs before the age of 18. Children's skin, particularly before the age of 10, is especially vulnerable to the harmful effects of ultraviolet rays. Just one blistering sunburn in childhood more than doubles the risk of skin cancer later in life [ADHS 2003c].

In February 2003, the Arizona Department of Health Services adopted the U.S. Environmental Protection Agency SunWise program, a national environmental and health education sun safety program for K-8 children that effects environmental and behavioral changes through a sun safety curriculum. Since the majority of sun exposure occurs before the age of 18, improving children's sun safety behaviors can impact skin cancer rates in adulthood. Since the inception of the Arizona SunWise School Program in February 2003, almost 600 schools statewide have enrolled in the program. SunWise Arizona has personally reached more than 11,000 children, trained 300 teachers, and formed partnerships with organizations such as the Maricopa Medical Society Alliance, American Cancer Society, American Red Cross, and the SHADE Foundation. Arizona is the first state to receive funding to implement the SunWise program through a two-year block grant from the Centers for Disease Control and Prevention, and now serves as a model for other states working to educate and protect children from melanoma and other skin cancers [ADHS 2003b].

Objectives and Strategies

Objective #1: Increase the percentage of Arizona children who regularly use effective sun protection by 2010. ***(Existing)***

Objective #2: Implement an effective media and public service campaign to promote sun protection for children in Arizona. ***(Proposed)***

Objective #3: Investigate methodology to increase reporting of all three forms of skin cancer in order to determine rates and prevalence for Arizona. ***(Proposed)***

Strategy #1: Introduce/increase student and teacher awareness of sun protective behaviors through the SunWise curriculum. *(Proposed)*

Strategy #2: Increase student ability to practice health-enhancing behaviors to further reduce the health risk of overexposure to the sun at home as well as at school. *(Proposed)*

Strategy #3: Provide children with scientific knowledge and develop an understanding of environmental concepts related to sun protection. *(Proposed)*

Strategy #4: Increase community awareness about the need for sun protection measures and how easy it is to prevent skin cancer. *(Proposed)*

Strategy #5: Create partnerships to further sun safety education among children and adults statewide. *(Proposed)*

Methylmercury in Fish

Health Concerns

Humans are exposed to methylmercury, a well-established neurotoxin, primarily through fish consumption. Once released into the environment, inorganic mercury is converted to organic mercury (methylmercury) which is the primary form that accumulates in fish and shellfish. Methylmercury biomagnifies up the aquatic food chain with the greatest levels found in top predators, such as pike, bass, and swordfish [EPA 2003d].

Dietary methylmercury is almost completely absorbed into the blood and distributed to all tissues including the brain. It also readily passes through the placenta to the fetus and fetal brain [EPA 2003e, 2003f]. The developing fetus is considered the most sensitive to the effects of methylmercury; therefore, women of childbearing age are the population of greatest concern. Children born of women exposed to relatively high levels of methylmercury during pregnancy have exhibited a variety of developmental abnormalities, including delayed onset of walking and talking, cerebral palsy, and reduced neurological test scores. Far lower exposures during pregnancy have resulted in delays and deficits in learning abilities in the children [EPA 2003e, 2003f].

The extent of exposure to mercury, and the blood mercury levels of United States women of reproductive age, are currently not known. An estimated 60,000 children are born each year in the United States at risk of suffering neurological and learning problems because their mothers consumed large amounts of mercury-contaminated fish and seafood during pregnancy. A study by the Centers for Disease Control and Prevention found that 8% of women of childbearing age had blood concentrations of methylmercury higher than the U.S. Environmental Protection Agency's recommended reference dose (RfD) for methylmercury of 0.1 ug/kg bw/day (micrograms per kilogram of body weight per day), below which exposures are considered to be without adverse effects [CDC 2001]. In a study of subjects whose diet was high in fish consumption, 89% had levels exceeding the U.S. Environmental Protection Agency reference dose. The mean level of methylmercury for women in this study was 10 times that of the methylmercury levels found in the study conducted by the Centers for Disease Control and Prevention [EHP 2003].

Freshwater Fish Advisory

Freshwater fish (caught by recreational or subsistence fishermen) from contaminated waters have been shown to have particularly high levels of methylmercury. Based on the reference dose, the U.S. Environmental Protection Agency has developed a criterion of 0.3 mg/kg (milligrams per kilogram) methylmercury in fish tissue that should not be exceeded in freshwater and estuarine fish to protect the health of consumers. The U.S. Environmental Protection Agency has issued an advisory for freshwater and estuarine fish which advises that women who are pregnant or could become pregnant, nursing mothers, and young children limit consumption of freshwater fish caught by family and friends from local waters to one meal per week. For adults, one meal is six ounces of cooked fish or eight ounces of uncooked fish; for a young child one meal is two ounces cooked fish or three ounces of uncooked fish [EPA 2003g].

Ocean and Commercial Fish Advisory

The U.S. Food and Drug Administration (FDA) issues consumption advice for ocean/coastal and commercial marine fish bought in stores and restaurants. For these fish, the Food and Drug Administration advises that women who are pregnant or could become pregnant, nursing mothers, and young children not eat shark, swordfish, king mackerel, or tilefish. Also, women of childbearing age and pregnant women may eat an average of 12 ounces of fish purchased in stores and restaurants each week. (Therefore, if in a given week you eat 12 ounces of cooked fish from a store or restaurant, then do not eat fish caught by your family and friends.) [EPA 2003g]

Important Controversy

For years, the U.S. Food and Drug Administration has been under criticism for using an "action level" for mercury in fish that is four times less stringent than the U.S. Environmental Protection Agency's criterion, and also for overlooking possible risks to the public of methylmercury in canned tuna and tuna steaks. The U.S. Food and Drug Administration plans to re-evaluate its current advice in light of a July 2000 report by the National Academy of Sciences that confirmed the U.S. Environmental Protection Agency's reference dose and its assessment of the health risks related to mercury exposure [EPA 2003g; NAS 2000]. Recent newspaper accounts indicate that the U.S. Food and Drug Administration may adopt the U.S. Environmental Protection Agency reference dose, and is considering developing a joint methylmercury fish consumption advisory for women and children with the U.S. Environmental Protection Agency.

Risk Summary (U.S. Environmental Protection Agency)

The U.S. Environmental Protection Agency offers this reasoned advice on methylmercury and fish consumption: "The typical U.S. consumer eating fish from restaurants and grocery stores is not in danger of consuming harmful levels of methylmercury from fish and is not advised to limit fish consumption. The levels of methylmercury found in the most frequently consumed commercial fish are low, especially compared to levels that might be found in some non-commercial fish from freshwater bodies that have been affected by mercury pollution. While most U.S. consumers need not be concerned about their exposure to methylmercury, some exposures may be of concern. Those who regularly and frequently consume large amounts of fish – either marine species that typically have much higher levels of methylmercury than the rest of seafood, or freshwater fish that have been affected by mercury pollution – are more highly exposed. Because the developing fetus may be the most sensitive to the effects from methylmercury, women of childbearing age are regarded as the population of greatest interest." The U.S. Environmental Protection Agency identifies subsistence fishermen (people who fish for their food) and some Native American populations at highest risk [EPA 2003e, 2003f].

Objectives and Strategies

Objective #1: Reduce the potential for methylmercury exposure in Arizona's children, women of reproductive age, and pregnant and nursing women. ***(Proposed)***

Strategy #1: The Department of Health Services will develop a webpage and written materials on recommended fish consumption levels for children, women of reproductive age, pregnant and nursing women, and older women and men. *(Proposed)*

Strategy #2: The Arizona Department of Health Services will continue to collaborate with the Arizona Department of Environmental Quality to review Arizona fish advisories. The Arizona Department of Game and Fish and Arizona Department of Environmental Quality will inform the public of contaminated water bodies in the State through public outreach including the development of website information and in written materials such as the Arizona Fishing Regulations.(*Proposed)*

Pesticide Exposure

What is a Pesticide?

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) defines a "pesticide" as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, or weeds, or any other forms of life declared to be pests, and any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant (FIFRA §2(u))." This definition encompasses: algicides; antifouling agents; antimicrobials; attractants; biopesticides; biocides; disinfectants and sanitizers; fungicides; fumigants; herbicides; insecticides; miticides; microbial pesticides; molluscicides; nematicides; ovicides; pheromones; repellents; rodenticides, as well as, defoliants; desiccants; and plant and insect growth regulators [EPA 2003h]. For regulatory purposes, the U.S. Environmental Protection Agency groups these pesticides into three categories: conventional; antimicrobials; and biopesticides [EPA 2003i]. There are currently more than 865 active ingredients registered as pesticides, formulated into more than 18,000 pesticide products in the marketplace [EPA 2002a]. Over 2 billion pounds of pesticides are applied to food crops, homes, schools, parks and forests in the United States each year. Annual expenditures for pesticides in the United States account for $11 billion – or about one-third of the world total of $33.5 billion [EPA 2002a].

Statutory and Regulatory Information

The Federal Insecticide, Fungicide and Rodenticide Act requires that all pesticides be registered by the U.S. Environmental Protection Agency before sale or distribution in the United States. The Federal Food, Drug and Cosmetic Act (FFDCA) authorizes the U.S. Environmental Protection Agency to set tolerances (maximum permissible pesticide residue levels) on food and animal feed. Both Acts were amended by the 1996 Food Quality Protection Act (FQPA), which established a new standard of food safety, i.e., a "reasonable certainty of no harm" from pesticide residues. When setting tolerances, the FQPA requires the U.S. Environmental Protection Agency to consider: susceptibility of children to exposure and adverse health effects; disruptive effects on the endocrine system; potential effects of *in utero* exposure; aggregate risk from all exposure sources and routes; and cumulative risks due to exposure to the pesticide and to pesticides with a common mechanism of toxicity. The FQPA also requires the U.S Environmental Protection Agency to apply an additional safety factor of 10 in its risk assessments to protect infants and children unless reliable data indicates a lesser standard would be safe [EPA 2003j; 2003k].

Under the Federal Insecticide, Fungicide and Rodenticide Act and state pesticide laws, states may place more restrictive requirements on pesticides than the U.S. Environmental Protection Agency and may register additional uses of federally registered pesticides based on special local needs. In general, states have primary authority for compliance monitoring and enforcing use of pesticides in violation of labeling requirements. In Arizona, the Arizona Department of Agriculture, Environmental Services Division is responsible for registering and licensing pesticide companies or products, enforcing pesticide use compliance, and training and certifying pesticide applicators. The Arizona Structural Pest Control Commission enforces state and federal laws governing the application of pest control technologies, and examines and licenses individuals and businesses engaged in the business of structural pest control.

Health Effects

Although the U.S. Environmental Protection Agency maintains an extensive website on pesticides, it contains relatively little information on the effects of pesticides on human health. An excellent source of information on pesticides and children is the National Academy of Sciences 1993 report, *Pesticides in the Diet of Infants and Children* [NAS 1993]. (Many provisions of the 1996 Food Quality Protection Act are codifications of the recommendations in this report.) The Natural Resources Defense Council has also produced some well-documented reports on pesticides and children's health that contain extensive reference sections, including *Trouble on the Farm* and *Our Children at Risk* [NRDC 1998, 1997]. The health effects that have been reported from pesticides include neurological effects, reproductive problems, interference with infant development, and cancer.

Neurotoxicity (Acute and Chronic)

The organophosphorus pesticides, and their close relative, the carbamate pesticides, are very widely used at present. The pyrethrins are the other major class of pesticides currently in use in the United States. Organophosphates and carbamates decay much more rapidly than organochlorines (e.g. DDT) and do not bioaccumulate up the food chain. These features make them an improvement in some ways over organochlorine pesticides; however, they are more acutely toxic. Organophosphates and carbamate pesticides are poisonous because they inhibit an enzyme called acetylcholineesterase, or AchE. When AchE is inhibited, acetylcholine, a neurotransmitter, builds up in the brain causing overstimulation of the nervous system. If the overstimulation goes on long enough, poisoning will occur and possibly the nerve cells involved will quit working. The symptoms of poisoning from AchE-inhibiting pesticides can be summarized with the acronym MUDDLES: miosis (pinpoint pupils); urination; diarrhea; diaphoresis (profuse sweating); lacrimation (tearing eyes); excitation of the central nervous system; and salivation. If a severe overdose of an AchE inhibitor goes untreated, the person may stop breathing and death will follow [Moore 2003]. The American Association of Poison Control Centers reports that in 2000 an estimated 73,000 children were involved in common household pesticide-related poisonings or exposures in the United States [EPA 2003]. As expected, the organophosphate and carbamate pesticides are the most likely pesticides to cause acute poisoning. From 1993 to 1996, nearly 63,000 reports were made to U.S. poison control centers about unintentional residential exposures to organophosphate pesticides. Almost 25,000 of these incidents involved children under six; of these, at least 482 required hospitalization [NRDC 2000].

The evidence of chronic effects in infants and children, particularly neurobehavioral effects of organophosphate and carbamate exposure, is less well established, but is strongly suggestive. Similar to the "lead model," data suggest that low-level exposures to pesticides may have subtle, but measurable, effects on neurologic function. Human brain development continues for years after birth, with the most significant brain development and structural alterations occurring at 4-6 years of age. Post-natal exposure to neurotoxic pesticides could alter the structure or function of the human nervous system if it occurred during this vulnerable period. According to the National Academy of Sciences, "the data strongly suggest that exposure to neurotoxic compounds at levels believed to be safe for adults could result in permanent loss of brain

function if it occurred during the prenatal or early childhood period of development" and "neurodevelopment effects must be part of the battery of end points evaluated for toxicants, including pesticides and agricultural chemicals." [NAS 1993]. As a result of this recommendation, animal neurodevelopmental testing is now required for new pesticide substances and for re-registration of substances already in use, but not studies in humans [Moore 2003].

Endocrine Disruption

A substantial number of chemicals, including pesticides, may disrupt the hormone (endocrine) systems of humans and wildlife causing reproductive disorders, birth defects, immune dysfunction, and other harmful effects. Endocrine disruptor effects have been described in the laboratory and in wildlife, including birds, fish, shellfish, mammals, alligators and turtles. In humans, however, the effect of endocrine disruptors is poorly understood and scientifically controversial. Due to the potentially serious consequences of human exposure to endocrine disrupting chemicals, Congress mandated the U.S. Environmental Protection Agency to develop an endocrine disruptor screening program in the 1996 Food Quality Protection Act and to screen for endocrine disruptors found in drinking water in the amended Safe Water Drinking Act of 1996 [EPA 2002b]. Some commonly used pesticides suspected of being endocrine disruptors are: the herbicides 2,4-D, alachlor, atrazine, and carbaryl; the insecticides fonofos and benomyl; and the fungicide metiram [UWEX 2000; PN 1999]. Banned organochlorine pesticides strongly suspected of being endocrine disruptors include dieldrin, DDT, chlordane, aldrin, kepone, mirex, endrin, and toxaphene [EPA 2002b]. Organochlorine pesticides still registered for use in the United States, including endosulfan, lindane, methoxychlor, dicofol, dienochlor, and heptachlor, are scheduled to be among the first compounds evaluated in the endocrine disruptor screening program [EPA 2002c]. The best known example of a human endocrine disruptor is diethylstilbestrol (DES), which caused very high rates of unusual vaginal cancers in the daughters of the mothers who had taken the drug to prevent miscarriage. Polychlorinated biphenyls (PCBs), another well-known endocrine disruptor, have caused reproductive problems in fish and fish-eating birds of the Great Lakes.

Cancer, Reproductive and Developmental Toxicity, and Immunotoxicity

Approximately 60 registered pesticides currently in use are classified as known, likely, or probable human carcinogens [EPA 2003m]. In addition, residues from approximately 10 banned chlorinated hydrocarbon pesticides classified as probable carcinogens still persist in the environment. Studies suggest an association between parental exposure (occupational or otherwise) to pesticides and childhood cancers, most commonly leukemia. • Many pesticides are known or suspected reproductive toxicants. The National Academy of Sciences cited a case of maternal exposure to multiple agricultural chemicals in Iowa and Michigan and increased risk of facial clefts among offspring, and another case of limb reduction defects in the offspring of agricultural workers in California exposed to organophosphate pesticides [NAS 1993]. • The successful development and functioning of the immune system requires recognition and response to a range of cellular and circulating signals. These complex control systems offer multiple opportunities for disruption by environmental chemicals, such as agricultural pesticides. Numerous animal studies show a variety of effects of pesticides on the immune system, including decreased antibody formation and immunity [NAS 1993].

Exposure

Pesticides may be inhaled, ingested, or absorbed dermally. The 1996 Food Quality Protection Act requires the U.S. Environmentally Protection Agency to consider pesticide exposure from food, drinking water, and all non-occupational sources of exposure (i.e. aggregate exposure) when establishing pesticide tolerances. Table 1 shows dietary and nondietary sources of exposure suggested by the National Academy of Sciences [NAS 1993].

Table 1. Dietary and Nondietary Sources of Pesticide Exposure to Children

Sources of Exposure	Comment
Dietary Exposure	
Food	Detectable levels of at least one pesticide in food samples were 62% (1994), 68% (1996), and 55% (1998). Less than 0.2% of all foods sampled each year had residues that violated established tolerances [EPA 2003s]
Drinking Water	The pesticides, ethylene dibromide (EDB) and dibromochloropropane (DBCP), are major pollutants contaminating Arizona groundwater. Atrazine, methomyl, metribuzin, and prometryn have also been found in groundwater of Maricopa and Yuma counties. 116 pesticide compounds were found at very low levels in 12 water supply reservoirs throughout the United States [ADEQ 2002; USGS 2001]
Nondietary Exposure	
Parental Exposure	*In utero* or take-home exposures on clothes.
Outdoor Air	Aerial drift either as vapors or bound to particles. Significant exposure possible in urban and suburban developments interspersed within agricultural land.
Indoor Air	Most home-use products contain either organophosphates or carbamates. Use of pesticides in schools and day-care centers are additional sources of exposure.
Exposure Via Contaminated Surfaces	Home Surfaces – Indoor insecticide sprays may persist on carpets, floors, and other home surfaces. Young children, particularly those wearing only diapers, may be exposed while playing. Pet Products – Flea control products may persist on the pet's fur. Playground Equipment – Wooden playground equipment may contain preservatives to prevent microbial or insect attacks.
Exposure Via Medication And Personal Products	Insect Repellents – DEET is the active ingredient in many insect repellents. Lindane and Malathion – Lindane (a chlorinated hydrocarbon pesticide) has been used as a shampoo for the treatment of head lice. Malathion has been recommended as a preferable treatment over lindane. Lanolin – A derivative of sheep's wool used on sore, cracked skin and sometimes applied directly to children's skin. Diazinon, chlorpyrifos, and organochlorine pesticides have been found in measurable levels in lanolin from the sheep dip process.
Occupational Exposures	In agricultural communities, children are often directly exposed to pesticides when they accompany their parents in the field or work there themselves.
Exposure Via Accidental Ingestion	Most poisonings take place in the home and are the result of careless storage of the original container or placement in unmarked or uncovered containers.

Farm Children and Children of Farmworkers

Scientific data strongly suggests that children living on or adjacent to agricultural land, children working on farms, and children whose parents work in the fields have significantly greater pesticide exposure than non-farm children. Farm children may be exposed to pesticides doing farm work, by eating fruits and vegetables directly from the field, by being caught in the drift from field application of pesticides, through contaminated soil in areas where they play, household dust, and by take-home exposures such as from their parent's clothing. The greatest

pesticide exposures are likely to children of migrant farmworker families, usually poor people of color or recent immigrants. In the United States, children rarely enter most workplaces, such as factories, mines, and even offices, but young children are frequently present in agricultural fields either working or accompanying parents. On the basis of thousands of inspections of agricultural establishments, the Department of Labor's Wage and Hour Division reported in 1999 that "farmworker children [are] forced to suffer long hours in the fields with both parents working and [virtually] no day care alternatives." The legal work age in the United States for agriculture is generally 12 years old; however, surveys have reported children as young as 4 working in the fields and, of course, children of farmers can work on their parent's farm at any age [GAO 2000; NRDC 1998]. On September 16, 2003, the Attorneys General from New York, New Jersey, Massachusetts, and Connecticut and a coalition of environmental and public interest groups filed two separate lawsuits against the U.S. Environmental Protection Agency contending that the agency has violated the 1996 Food Quality Protection Act by failing to use the tenfold infant and child protection safety factor. The coalition's lawsuit also alleges that the agency has failed to protect highly vulnerable or highly exposed people, particularly farmworkers' children and other children living on or near farms [AGO 2003; NRDC 2003].

Exposure Studies

There are two categories of exposure estimates: internal and external. Internal exposure is a measure of how much of the substance has actually entered the person or has been metabolized and excreted by the person. Measures of external exposure estimate the amount of substance that is outside the person but that has potential to enter the person. Three studies estimating internal pesticide exposure in children are the: Arizona Children's Exposure Survey [O'Rourke et.al. 2000]; the Minnesota Children's Exposure Study [EPA 2003n]; and the Study of Children of Washington Orchard Workers [Lu et.al. 2000]. In the Arizona study, a team of researchers from the University of Arizona and U.S. Environmental Protection Agency measured the urinary metabolites of pesticides in a sample of children 2 to 5 years old in Yuma County. The researchers found that one-third of the children had detectable levels of urinary metabolites of a least one orthophosphate pesticide. The study also showed that daily dosages of at least two pesticides would exceed the U.S. Environmental Protection Agency's reference doses in the highest 5% of children: diazinon (10 to 24 times) and methyl parathion (11 to 49 times the reference dose). The researchers concluded that the likely source of these high values was exposure from parents who work in agriculture bringing pesticides home on their clothes, and pesticide drift from the fields.

The Minnesota Children's Pesticide Exposure Study conducted by the U.S. Environmental Protection Agency in collaboration with the State of Minnesota in 1997 tested 102 children 3-13 year old for pesticides. A major metabolite of the organophosphate pesticide, chlorpyrifos (trade name Dursban), the most commonly used pesticide in homes, schools, and buildings, was present in 98% of the children's urine samples. Its concentrations were significantly higher in urban than in non-urban children, and about twice as high as those measured for adults in previous studies [EPA 2003n]. On June 8, 2000, the U.S. Environmental Protection Agency eliminated the use of chlorpyrifos for residential indoor and lawn uses, and allowed significantly lower residues on certain crops, including fruits and vegetables regularly eaten by children.

In the children of orchard workers study conducted by the University of Washington, researchers found that the urine of agricultural children had approximately 5 times the orthophosphate pesticide metabolites than children from nonagricultural families. The researchers concluded that 56% of the agricultural children would exceed the chronic reference dose for azinphos methyl and 9% would exceed the chronic reference dose for the pesticide phosmet.

Objectives and Strategies

Objective #1: Reduce the pesticide exposure of Arizona's urban, rural, and farm children, and the children of Arizona farmworkers. ***(Proposed)***

Strategy #1: Provide the public with information on the health effects of pesticides and ways to reduce exposure through public outreach including the development of website information and written materials. Specific information will be developed for farm and non-farm exposures and for children. *(Proposed)*

Strategy #2: Work with other government entities, private and nonprofit organizations, and interested individuals to reduce exposure to Arizona farmworkers and the children of Arizona farmworkers. *(Proposed)*

References

[ACERP 1995] Arizona Comparative Environmental Risk Project, Section 3. Human Health. 1995. Available from URL: http://www.learnweb.com/azeenet/archive/acerp.htm. Last accessed October 6, 2003.

[ADEQ 2002] Arizona Department of Environmental Quality. 2002. Groundwater Protection in Arizona: An Assessment of Groundwater Quality and the Effectiveness of Groundwater Programs, A.R.S. §49-249. Available from URL: http://www.adeq.state.az.us/comm/pubs/download/2002/five.pdf. Last accessed November 22, 2003.

[ADHS 2001a] Arizona Department of Health Services. 2001. Healthy Arizona 2010 Strategic Plan. Available from URL: http://www.hs.state.az.us/phs/healthyaz2010/. Last accessed October 1, 2003.

[ADHS 2001b] Arizona Department of Health Services. 2001. The screening policy & guidance for preventing childhood lead poisoning in Arizona: Health Effects. Available from URL: http://www.hs.state.az.us/phs/oeh/invsurv/lead/bklet_policy.htm. Last accessed November 22, 2003.

[ADHS 2001c] Arizona Department of Health Services. 2001. The screening policy & guidance for preventing childhood lead poisoning in Arizona: Pathways to lead exposure. Available from URL: http://www.hs.state.az.us/phs/oeh/invsurv/lead/bklet_policy.htm. Last accessed November 22, 2003.

[ADHS 2001d] Arizona Department of Health Services. 2001. The screening policy & guidance for preventing childhood lead poisoning in Arizona: Sources of lead exposure. Available from URL: http://www.hs.state.az.us/phs/oeh/invsurv/lead/bklet_policy.htm. Last accessed November 22, 2003.

[ADHS 2001e] Arizona Department of Health Services. 2001. The screening policy & guidance for preventing childhood lead poisoning in Arizona: Childhood lead poisoning in AZ. Available from URL: http://www.hs.state.az.us/phs/oeh/invsurv/lead/bklet_policy.htm. Last accessed November 22, 2003.

[ADHS 2002] Cases of valley fever continue to rise. Prevention Bulletin November/December 2002, Vol. 16, No. 6. Available from URL: http://www.hs.state.az.us/diro/pio/preventionbulletin/. Last accessed October 13, 2003.

[ADHS 2003a] Arizona Department of Health Services. 2003. Arizona's Childhood Lead Poisoning Targeted Screening Plan. Available from URL: http://www.hs.state.az.us/phs/oeh/index.htm. Last accessed October 6, 2003

[ADHS 2003b] Arizona Department of Health Services. 2003. Lead poisoning in Arizona, Annual Report 2002. Available from URL: http://www.hs.state.az.us/phs/oeh/invsurv/lead/leadbrochpub.htm. Last accessed November 22, 2003.

[ADHS 2003c] Arizona Department of Health Services. 2003. Fact Sheet (SunWise). Available from the Office of Environmental Health.

Adler, Jerry. 2003. Newsweek, September 22, 2003. The Allergy Epidemic. pp. 51-57.

[ALA 2003a] American Lung Association. 2003. Childhood asthma: An overview. Available from URL: http://www.lungusa.org/asthma/ascchildhoo.html. Last accessed October 2, 2003.

[ALA 2003b] American Lung Association. 2003. Trends in Tobacco Use. Available from URL: http://www.lungusa.org/data/. Last accessed October 13, 2003.

Balluz, Lina, Rossanne Philen, Luis Ortega, Cecilia Rosales, John Brock, Dana Barr, and Stephanie Kieszak. 2001. Investigation of Systemic Lupus Erythematosus in Nogales, Arizona. American Journal of Epidemiology Vol. 154, No. 11: 1029-1036.

Bass, Judith K., Luis Ortega, Cecilia Rosales, Normal J. Petersen, and Rossanne M. Philen. 2001. What's being used at home: a household pesticide survey. Pan Am J Public Health 9(3), 138-144. Available from URL: http://www.paho.org/english/DB1/es/03-Bass.pdf. Last accessed December 15, 2003.

[CALEPA 2003a] California Environmental Protection Agency. 2003. Building a children's environmental health program: California's experience. Presentation by Nancy Sutley at the Arizona Children's Environmental Health Forum, Phoenix, AZ, May 30, 2003. Available from URL: http://www.ev.state.az.us/environ/init/download/sutley.pdf. Last accessed October 3, 2003.

[CALEPA 2003b] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. 2003. Prioritization of toxic air contaminants-Children's Environmental Health Protection Act-Final Report. Available from URL: http://www.oehha.org/air/toxic_contaminants/SB25finalreport.html. Last accessed October 14, 2003.

Canfield, R.L., Henderson C.R. Jr., Cory-Slechta, D.H., Cox C., Jusko, T.A., Lanphear, B.P. 2003. Intellectual impairment in children with blood lead concentrations below 10 ug per deciliter. New England Journal of Medicine. 348:1517-1526 (April 17, 2003).

[CDC 2000] Centers for Disease Control and Prevention. 2000. Report on Investigation of Systemic Lupus Erythematosus, Nogales, Arizona. November 14, 2000, 26 pp.

[CDC 2001] Centers for Disease Control and Prevention. Blood and hair mercury levels in young children and women of childbearing age – United States 1999. MMWR Weekly, March 02, 2001/50(08); 140-3. Available from URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5008a2.htm. Last accessed October 3, 2003.

[CDC 2002a] Centers for Disease Control and Prevention. Coccidioidomycosis. Available from URL: http://www.cdc.gov/ncidod/dbmd/diseaseinfo/coccidioidomycosis_t.htm. Last accessed October 3, 2003.

[CDC 2002b] Centers for Disease Control and Prevention. 2002. Pesticide Exposure in Children Living in Agricultural Areas Along the United States – Mexico Border, Yuma County. Prepared for the Office of Border Health of the Arizona Department of Health Services.

[CHEC 2003] 2003. The state of children's health and environment, common sense solutions for parents and policymakers. By John and Linda Evenson Wargo. http://www.checnet.org. Last accessed October 3, 2003.

[DHHS 2000] 2000. Healthy People 2010. Available from http://www.healthypeople.gov. Last accessed October 3, 2003.

[EHHI 2003] Environment and Human Health, Inc. Children's exposures to diesel exhaust on school buses. 2003. Available from http://www.ehhi.org/pubs/children_diesel.html. Last accessed October 3, 2003.

[EHP 2003] Environmental Health Perspectives. 2003. Mercury levels in high-end consumers of fish. Volume 111, Number 4, April 2003, Pages 604-608.

[EPA 1999] U.S. Environmental Protection Agency. 1999. Implementing the Food Quality Protection Act: Progress Report. Available from URL: http://www.epa.gov/oppfead1/fqpa/fqpastatus.htm. Last accessed November 22, 2003.

[EPA 2002a] U.S. Environmental Protection Agency. 2002. Promoting safety for America's future. Office of Pesticide Programs Annual Report 2002. Available from URL: http://www.epa.gov/oppfead1/annual/index.htm. Last accessed November 22, 2003.

[EPA 2002b] U.S. Environmental Protection Agency. 2002. What are endocrine disruptors? Available from URL: http://www.epa.gov/scipoly/oscpendo/whatis.htm. Last accessed November 22, 2003.

[EPA 2002c] U.S. Environmental Protection Agency. 2002. Endocrine Disruptor Screening Program Web Site. Available from URL: http://www.epa.gov/scipoly/oscpendo/. Last accessed November 22, 2003.

[EPA 2003a] U.S. Environmental Protection Agency. 2003. Clean School Bus USA. Available from URL: http://www.epa.gov/cleanschoolbus/. Last accessed October 8, 2003.

[EPA 2003b] U.S. Environmental Protection Agency. 2003. Asthma Frequent Questions. Available from URL: http://www.epa.gov/asthma/introduction.html. Last accessed October 6, 2003.
[EPA 2003c] U.S. Environmental Protection Agency. 2003. Smoke-free homes, health effects. Available from http://www.epa.gov/smokefree/healthrisks.html. Last accessed October 3, 2003.

[EPA 2003d] U.S. Environmental Protection Agency. 2003. Mercury Update: Impact on fish advisories. Available from URL: http://www.epa.gov/waterscience/fishadvice/mercupd.pdf. Last accessed October 13, 2003.

[EPA 2003e] U.S. Environmental Protection Agency. 2003. Mercury study report to congress: overview. Available from URL: http://www.epa.gov/airprogm/oar/mercover.html. Last accessed October 3, 2003.

[EPA 2003f] U.S. Environmental Protection Agency. 2003. Mercury study report to congress. http://www.epa.gov/oar/mercury.html. Last accessed October 13, 2003.

[EPA 2003g] U.S. Environmental Protection Agency. 2003. Consumption Advice. EPA National advice on mercury in freshwater fish for women who are or may become pregnant, nursing mothers, and young children. Available from URL: http://www.epa.gov/waterscience/fishadvice/advice.html. Last accessed October 6, 2003.

[EPA 2003h] U.S. Environmental Protection Agency. 2003. Types of pesticides. Available from URL: http://www.epa.gov/pesticides/about/types.htm. Last accessed November 22, 2003.

[EPA 2003i] U.S. Environmental Protection Agency. 2003. Registering pesticides. Available from URL: http://www.epa.gov/pesticides/regulating/registering. Last accessed November 22, 2003.

[EPA 2003j] U.S. Environmental Protection Agency. 2003. Pesticides: Regulating pesticides. The Food Quality Protection Act (FQFA) Background. Available from URL: http://www.epa.gov/oppfead1/fqpa/backgrnd.htm. Last accessed November 5, 2003.

[EPA 2003k] U.S. Environmental Protection Agency. 2003. Pesticides: Regulating pesticides. Laws. Available from URL: http://www.epa.gov/pesticides/regulating/laws.htm. Last accessed November 5, 2003.

[EPA 2003l] U.S. Environmental Protection Agency. 2003. Pesticides and child safety. Available from URL: http://www.epa.gov/pesticides/factsheets/childsaf.htm. Last accessed November 22, 2003.

[EPA 2003m] U.S. Environmental Protection Agency. 2003. Chemicals evaluated for carcinogenic potential. Office of Pesticide Programs. 18 pp.

[EPA 2003n] U.S. Environmental Protection Agency. 2003. Minnesota children's pesticide exposure study (MCPES). Available from URL: http://www.epa.gov/nerl/research/2001/g3-3.html. Last accessed November 22, 2003.

[EPA 2003o] U.S. Environmental Protection Agency. 2003. Border 2012: U.S.-Mexico environmental program. Available from URL: http://epa.gov/usmexicoborder/pdf/2012_english.pdf. Last accessed November 17, 2003.

[EPA 2003p] U.S. Environmental Protection Agency. 2003. US-Mexico environmental program: Border 2012. organization. Available from URL: http://www.epa.gov/r6border/org.htm. Last accessed November 16, 2003.

[EPA 2003q] U.S. Environmental Protection Agency. 2003. The Good Neighbor Environmental Board. Available from URL: http://www.epa.gov/ocem/gneb-page.htm. Last accessed November 22, 2003.

[EPA 2003r] U.S. Environmental Protection Agency. 2003. Draft seventh report of the Good Neighbor Environmental Board to the President and Congress.

[EPA 2003s] U.S. Environmental Protection Agency. 2003. Pesticide residues in foods – American's children and the environment: A first view of available measures. Available from URL: http://yosemite.epa.gov/ochp/ochpweb.nsf/content/food_contam.htm. Last accessed November 22, 2003.

[GAO 2000] United States General Accounting Office. 2000. Pesticides: Improvements needed to ensure the safety of farmworkers and their children. GAO/RCED-00-40. Available from URL: http://www.gao.gov/new.items/rc00040.pdf. Last accessed November 22, 2003.

Lu, C., Fenske, R.A., Simox, N.J., & Kalman, D. 2000. Pesticide exposure of children in an agricultural community: Evidence of household proximity to farmland and take home exposure pathways. Environmental Research, Section A, 84, 290-302.

Martinez, Fernando D. M.D. 2003. Respiratory disease and asthma in children in Arizona. A presentation to the Arizona Children's Environmental Health Forum, Phoenix, AZ, May 30, 2003.

Moore, Colleen F. 2003. Silent scourge, children, pollution, and why scientists disagree. Oxford University Press. 318 pp.

[NAS 1993] National Academy of Sciences. Pesticides in the diets of infants and children. Washington: National Academy Press, 1993. Available from URL: http://www.nap.edu/catalog/2126.html. Last accessed November 22, 2003.

[NAS 2000] National Academy of Sciences. 2000. Toxicological effects of methylmercury. National Academies Press. 344 pp. Available from URL: http://www.nap.edu/openbook/0309071402/html/1.html. Last accessed October 13, 2003.

[NRDC 1997] Natural Resources Defense Council. 1997. Our children at risk: The five worst environmental threats to their health. Available from URL: http://www.nrdc.org/health/kids/depth.asp. Last accessed November 22, 2003.

[NRDC 1998] Natural Resources Defense Council. 1998. Trouble on the Farm: Growing up with pesticides in agricultural communities. Available from URL: http://www.nrdc.org/health/kids/depth.asp. Last accessed November 22, 2003.

[NRDC 2000] Natural Resources Defense Council. 2000. Organophosphate and carbamate insectides. Available from URL: http://www.nrdc.org/health/pesticides/forgano.asp. Last accessed November 22, 2003.

[NRDC 2003a] Natural Resources Defense Council. Exhausted by diesel, Chapter 2 Human health impacts. Available at URL: http://www.nrdc.org/air/transportation/ebd/chap2.asp. Last accessed October 3, 2003.

[NRDC 2003b] Natural Resources Defense Council. States, enviros challenge EPA standards for exposure. Available at URL: http://www.nrdc.org/news/news/. Last accesssed November 22, 2003.

O'Rourke, M.K., Lizardi, P.S., Rogan, S.P., Freeman, N.C. Aguirre, A., & Saint, C.G. 2000. Pesticide exposure and creatinene variation among young children. Journal of Exposure analysis and Environmental Epidemiology, 10, 672-681.

O'Rourke, Mary Kay, Bronson, Daniel, and Daniel Osgood. 2002. Pesticide Exposure Potential In the Yuma County, Arizona Study Area. Prepared for Arizona Department of Health Services.

[OAG 2003] Office of the Massachusetts Attorney General. Press Release: States sue EPA for failing to protect children from pesticides. Available from URL: http://www.ago.state.ma.us/txt/fqpa.htm. Last accessed November 22, 2003.

[PN 2000] Pesticide News. Endocrine disrupting pesticides. Available from URL: http://www.pan-uk.org/pestnews/actives/endocrin.htm. Last accessed November 22, 2003.

[PTF 2000] President's Task Force on Environmental Health, Risks and Safety Risks to Children. 2000. Asthma and the environment: A strategy to protect children. Available from URL: http://yosemite.epa.gov/ochp/ochpweb.nsf/content/whatwe_tf_proj.htm. Last accessed October 6, 2003.

[PTF 2003] President's Task Force on Environmental Health Risks and Safety Risks to Children. 2003. Activities and accomplishments. Available from URL:

http://www.yosemite.epa.gov/ochp/ochpweb.nsf/content/Whatwe_fedtask.htm. Last accessed November 22, 2003.

[USGS 2001] United States Geological Survey. 2001. Pesticides in selected water-supply reservoirs and finished drinking water, 1999-2000: Summary of results from a pilot monitoring program. Available from URL: http://md.water.usgs.gov/nawqa/. Last accessed November 22, 2003.

[USMBHC 2003a] United States-Mexico Border Health Commission. Healthy Border 2010: An agenda for improving health on the United States-Mexico border. Available from URL: http://www.borderhealth.org/files/res_34.pdf. Last accessed November 22, 2003.

[UMBHC 2003b] United States-Mexico Border Health Commission. Border Region. Available from URL: http://www.borderhealth.org/border_region.php. Last accessed November 22, 2003.

[UA 2002] The University of Arizona Health Sciences Center. Prevalence of allergic rhinitis and asthma in the Southwest. Available from URL: http://www.peds.arizona.edu/allergyimmunology/southwest/prevalence.html. Last accessed October 6, 2003.

[UA 2003a] The University of Arizona Health Sciences Center. Allergy and asthma in the southwestern United States. Allergenic pollen in the Southwest. Available from URL: http://www.peds.arizona.edu/allergyimmunology/southwest/swpollen.html. Last accessed October 6, 2003.

[UA 2003b] The University of Arizona Health Sciences Center. Allergy and asthma in the southwestern United States. Available from URL: http://www.peds.arizona.edu/allergyimmunology/southwest/index.html. Last accessed October 13, 2003.

[UA 2003c] The University of Arizona Health Sciences Center. Allergy and asthma in the southwestern united states. Mold spores. Available from URL: http://www.peds.arizona.edu/allergyimmunology/southwest/mold.html. Last accessed October 6, 2003.

[UWEX 2000] University of Wisconsin Extension. 2000. Current issues in FQPA. Available from URL: http://www.uwex.edu/ces/susag/PURR/FQPA.html. Last accessed November 22, 2003.

[VFCE 2003a] Valley Fever Center for Excellence. What is valley fever? Available from URL: http://www.arl.arizona.edu/vfce/. Last accessed October 3, 2003.

[VFCE 2003b] Valley Fever Center for Excellence. Common questions. Available from URL: http://www.arl.arizona.edu/vfce/. Last accessed October 3, 2003.

Appendix
Border Health

Background

The United States–Mexico border region is 2,000 miles long, stretching from San Ysidro, California, to Brownsville, Texas, and extending 100 kilometers (62.5 miles) north and south of the international boundary (La Paz Agreement). Today, the border region is home to more than 11.8 million people, with approximately 6.3 million in the United States and 5.5 million in Mexico living in 10 border states (4 in the United States and 6 in Mexico). The border population is expected to double by 2025. Approximately 90 percent of the border population lives in 14 pairs of sister cities that straddle the international boundary. Mexico's three largest *municipios* – Ciudad Juárez, Chihuahua, and Tijuana and Mexicali, Baja California – account for slightly more than half of the total Mexican border population. Nearly two-thirds of the United States border population is concentrated in three counties: San Diego, California; Pima, Arizona; and El Paso, Texas. The United States-Mexico border is recognized as one of the busiest in the world with 43 points-of-entry. Every day, 800,000 people arrive in the United States from Mexico. In 2001, there were over 300 million two-way legal border crossings [USMBHC 2003a].

Border Health Overview

The United States-Mexico border is a dynamic region that is medically underserved with a population that has pressing health and social conditions, higher uninsured rates, high rates of migration, inequitable health conditions, and a high rate of poverty. Although there have been significant economic changes due to international trade agreements with Mexico, there continues to be major problems associated with the general poverty of the border area. Of the 3.8 million children that live in the border region, approximately 2 million or 53% live in poverty [GNEB 2003]. According to the Health Resources and Service Administration, if the border region was made the 51st state, it would [USMBHC 2003]:

- Rank last in access to health care;
- Second in death rates due to hepatitis;
- Third in deaths related to diabetes;
- Last in per capita income;
- First in numbers of children living in poverty; and
- First in numbers of children who are uninsured

Pollutants that arise on one side of the border can easily affect air, water, soil, and human health on the other side of the border. Also, the enormous interplay of people due to migration into the area and border crossings increases health risks at the international line, especially the spread of infectious disease. Consequently, the United States-Mexico border region should be viewed as one epidemiological unit requiring a coordinated, binational approach to address human and environmental health issues. There are two major binational programs working to improve human health on both sides of the United States-Mexico border: the **Healthy Border/Healthy *Gente* 2010 Program** which addresses human health issues and the **Border 2012 Program** which addresses environmental and environmentally-related human health issues. These programs, and the **Good Neighbor Environmental Board**, are discussed below.

The Healthy Border/Healthy *Gente* 2010 Program

Healthy Border 2010 (*Programa Frontera Saludable 2010)* is a binational agenda of health promotion and disease prevention established by the United States-Mexico Border Health Commission (USMBHC) in March of 2001. Healthy Border 2010 combines common elements of health programs from both Mexico and the United States. From Mexico, it draws on the *Indicadores de Resultado* (National Health Indicators Program). From the United States, it is a border-related subset of the Healthy People 2010 Program called the Healthy *Gente* Program (*Gente* is the Spanish word for people).

Goals and Objectives

The two overarching goals of Healthy Border/Healthy *Gente* 2010 are the same as those of Healthy People 2010, the national set of health objectives [DHHS 2003]. They are:

1. Improve the quality of life and increase the number of years of healthy life, and
2. Eliminate health disparities

Healthy Border 2010 has 20 health objectives grouped into 11 topic areas, as described in the Commission's recently released report, *Healthy Border 2010: An Agenda for Improving Health on the United States-Mexico Border* [USMBHC 2003]. The Healthy *Gente* 2010 Program adds three additional topic areas- Tobacco Use, Substance Abuse, and Nutrition and Obesity – for a total of 14 topic areas:

Table 1. Healthy Border/Healthy *Gente* 2010 Topic Areas.

Healthy Border/Healthy *Gente* 2010 Topic Areas		
	Topic Area	**Description**
1	**Access to Health Care**	Ensure access to primary care or basic health care.
2	**Cancer**	Reduce breast cancer and cervical cancer mortality.
3	**Diabetes**	Reduce the mortality rate of diabetes and the need for hospitalization.
4	**Environmental Health****	Improve household access to sewage disposal. Reduce hospital admissions for acute pesticide poisoning.
5	**HIV/AIDS**	Reduce the number of cases of HIV/AIDS.
6	**Immunization and Infectious Diseases**	Expand immunization coverage for young children; Reduce the incidence of hepatitis and tuberculosis.
7	**Injury Prevention**	Reduce mortality from motor vehicle crashes.
8	**Maternal, Infant and Child Health**	Reduce overall infant mortality and deaths due to congenital defects. Improve prenatal care. Reduce teenage pregnancy rates.
9	**Mental Health**	Reduce suicide mortality.
10	**Oral Health**	Improve access to oral health care.
11	**Respiratory Diseases****	Reduce rate of hospitalization for asthma.
12	**Tobacco Use**	Reduce use by adults and adolescents.
13	**Substance Abuse**	Reduce alcohol and drug use by youth and alcohol-related motor vehicle deaths.
14	**Nutrition and Obesity**	Reduce proportion of adults who are obese.

Environmental Health Objectives

Table 2 shows the subset of Healthy Border/Healthy *Gente* 2010 objectives that are specifically related to environmental health, i.e. human exposure to contaminants in air, water, soil, and food. These objectives fall into the Environmental Health and Respiratory Diseases topic areas.

Table 2. Healthy Border/Healthy *Gente* 2010 Environmental Health Objectives.

Environmental Health Objectives Healthy Border/Healthy *Gente* 2010		
Topic Area	**Year 2010 Objectives**	
	United States	**Mexico**
Environmental Health	Reduce to zero the proportion of households without complete bathroom facilities.	Reduce proportion of households not connected to sewage systems to less than 21.3%.
	Reduce hospitalizations for acute pesticide poisoning by 25%.	Maintain current level of hospitalizations for acute pesticide poisoning.
	Reduce to zero the proportion of persons living in counties exceeding EPA air quality standards. (Healthy *Gente* Objective)	
Respiratory Diseases (Asthma Hospitalization)	Reduce the hospital admission rate by 40%.	Keep the hospital admission rate stable.

Healthy Border/Healthy Gente 2010 Organization

The United States-Mexico Border Health Commission (USMBHC) is a binational organization, created in July 2000, dedicated to addressing the pervasive health needs of the United States-Mexico border. The Commission has 26 members, 13 from each country. Mexico's Secretary of Health and the U.S. Secretary of Health and Human Services act as commissioners. Other Commission members include the chief health officers of California, New Mexico, Arizona, and Texas, and two border residents from each state who have demonstrated interest and expertise in regional health issues and who have ties to community-based health organizations. Mexican membership in the Commission includes the secretaries of health of each of the six Mexican border states and one commissioner from each of those states. Arizona's commissioners are Cathy Eden, Director, Arizona Department of Health Services, Ema Torres, and Dr. Carlos R. Gonzales.

Office of Border Health

The Commission funds Outreach Offices in each of the four U.S. states, and four regional Outreach Offices in Mexico. The Arizona Department of Health Services, Office of Border Health, located in Tucson, oversees the activities of the Commission for the Arizona delegation and coordinates the Healthy Border/Healthy *Gente* 2010 program for the Arizona-Sonora, Mexico region. The Office of Border Health also participates in health projects and studies in the Arizona-Sonora region, sometimes in conjunction with the U.S. Environmental Protection Agency and/or the Centers for Disease Control and Prevention. Some of these studies are described at Border Health Studies and include the following:

•Investigation of Systemic Lupus Erythematosus in Nogales, Arizona [CDC 2000; Balluz et. al. 2001]
•Pesticide Exposure in Children Living in Agricultural Areas along the United States-Mexico Border, Yuma County, Arizona [O'Rourke et. al. 2002; CDC 2002]
•Household Pesticide Study in Douglas, Arizona [Bass et. al. 2001] and www.paho.org/english/DB1/es/03-Bass.pdf
•Pediatric Lead Assessment on the United States-Mexico Border [complete report available at the Office of Border Health]
•Nogales Absenteeism Project (asthma)
•Human pappillomavirus (HPV)/sexually transmitted diseases (STD) Prevalence along the Arizona-Sonora Border
•U.S.-Mexico Diabetes Border Project
•Borderwide Geographic Information Systems
•Sonora-Arizona Health Indicators

Sonora-Arizona Border Public Health Office

The Sonora-Arizona Public Health Office, located in Nogales Sonora, Mexico, is the outreach office of the Sonora delegation to the Commission. The Office is co-supported by both Sonora and Arizona. The primary objective of the Office is to employ epidemiological methods to identify health issues of concern to the border communities. The binational border health office has been instrumental in initiating many of the studies listed above in collaboration with the Colegio de Sonora and the University of Arizona. The Office has also been involved in the "Data Infrastructure Project," an ongoing project to collect, analyze, and disseminate epidemiologic data obtained from the border communities. This information filters down to state and local levels to assist planning efforts and is used to track overall trends along the Arizona-Sonora border.

Border 2012: U.S.-Mexico Environmental Program

Border 2012 was approved in April 2003 by the U.S. Environmental Protection Agency and Mexico's Secretariat of Environment and Natural Resources (SEMARNAT) in partnership with the U.S. Department of Health and Human Services, the Mexican Secretariat of Health, the ten United States-Mexico border states, and 25 U.S. tribal governments [EPA 2003o]. The focus of Border 2012 is to address serious environmental and environmentally-related public health challenges in the border region. Protection of public health is a key element of the Border 2012 program and an integral part of all program activities.

Goals and Objectives

Border 2012 consists of six border-wide goals and 19 objectives:

1. Reduce Water Contamination – 4 objectives
2. Reduce Air Pollution – 1 objective
3. Reduce Land Contamination – 4 objectives
4. Improve Environmental Health – 4 objectives
5. Reduce Exposure to Chemicals as a Result of Accidental Chemical Releases and/or Acts or Terrorism – 3 objectives

6. Improve Environmental Performance Through Compliance, Enforcement, Pollution Prevention, and Promotion of Environmental Stewardship-3 objectives

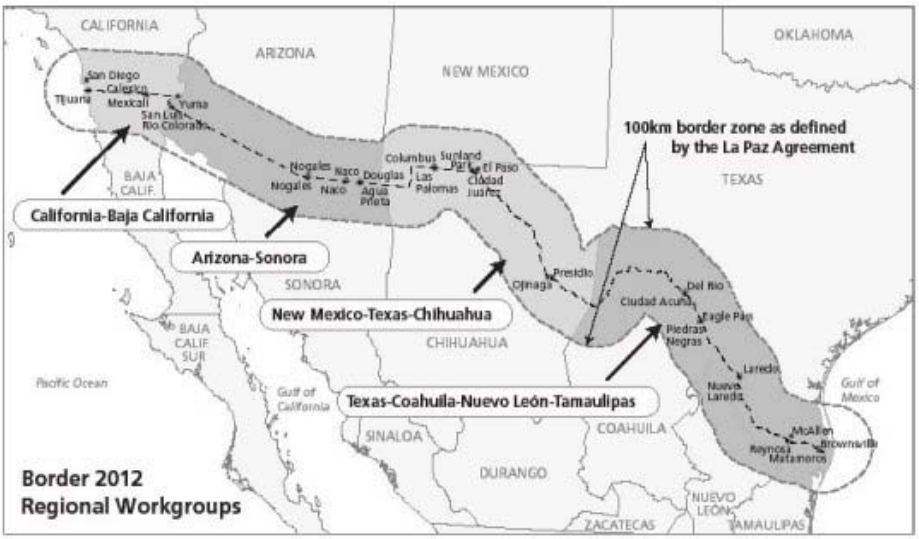
Seven of 19 Border 2012 objectives directly or indirectly address the environmental health objectives of the Healthy Border/Healthy *Gente* 2010 Program (shown in Table 2). These seven objectives are shown in Table 3.

Table 3. Border 2012 Objectives Which Address Healthy Border/Healthy *Gente* 2010 Environmental Health Objectives

Border 2012 Objectives Which Address Healthy Border 2010 Objectives	
Goals	**Border 2012 Objectives**
Reduce Air Pollution	By 2012 or sooner, reduce air emissions as much as possible toward attainment of respective national ambient air quality standards, and reduce exposure in the border region.
Reduce Water Contamination	By 2012, promote a 25% increase in the number of homes connected to potable water supply and wastewater collection and treatment systems.
Improve Environmental Health	(Air) By 2006, evaluate measures of respiratory health in children that might be tracked to assess changes that may result from actions to improve air quality in border communities.
	(Water) By 2006, evaluate measures of gastrointestinal illness that might be tracked to assess changes that may result from actions to improve water quality in border communities.
	(Pesticides) By 2006, an assessment and pilot program will be completed that explores the feasibility of harmonizing a binational system for reporting acute pesticide poisonings.
	(Pesticides) By 2007, reduce pesticide exposure by training 36,000 farmworkers on pesticide risks and safe handling, including ways to minimize exposure for families and children.
	(Pesticides & Water) By 2004, extend current efforts in binational environmental health training for 100 health care providers each for pesticides and water.

Border 2012 Organization

Under Border 2012, the National Coordinators of the U.S. Environmental Protection Agency and Mexico's Secretariat of Environment and Natural Resources (SEMARNAT) provide guidance and oversight to three types of binational coordinating bodies: Regional Workgroups; Border Workgroups; and Policy Forums. The four Regional Workgroups (shown in the map above) are the foundation of Border 2012. They are geographically-focused and emphasize regional public health and environmental issues. Border-wide Workgroups concentrate on issues that are multi-regional and primarily federal in nature (requiring direct, high level, and sustained leadership by federal program partners in the United States and Mexico). Policy Forums have a media-specific focus, concentrate on broad policy issues that require an ongoing dialogue between both countries, and provide technical assistance to Regional and Border-wide Workgroups [EPA 2003p].



Arizona-Sonora Environmental Health Workgroup/Task Forces

The Regional Workgroups, Border-wide Workgroups, and Policy Forums each have the opportunity to create Task Forces to implement projects at the local level. The Arizona-Sonora Environmental Health Workgroup recently identified five task forces for the Arizona-Sonora region. These are: 1) Ambos Nogales Air Quality Improvement; 2) Chemical Emergency Preparedness and Response; 3) Waste and Enforcement; 4) Water; and 5) **Children's Environmental Health.** Border 2012 activities in the Arizona-Sonora region are coordinated locally by the Arizona Department of Environmental Quality, Border Programs Unit in Tucson. Border 2012 projects and studies for the Arizona-Sonora region, including ones specifically related to children, can be found at the Border Programs Unit website (http://www.adeq.state.az.us/environ/regional/sro/download/proact.pdf), and at the Border 2012 Environmental Health Workgroup website (www.epa.gov/orsearth/projects.html).

Good Neighbor Environmental Board Children's Report

The Good Neighbor Environmental Board (GNEB) was created in 1992 by federal legislation to advise the U.S. President and Congress on good neighbor environmental and infrastructure practices along the U.S. border with Mexico [EPA 2003q]. The U.S. Environmental Protection Agency is responsible for management of the Board which includes senior officials from federal, state, local, and tribal governments, as well as the academic, private, and non-profit sectors.

The Draft Seventh Report of the Good Neighbor Environmental Board to the President and Congress focuses on the link between the health of border-region children and local environmental conditions [EPA 2003r]. Health concerns cited in the report that parallel the objectives of Healthy Border/Healthy *Gente* 2010 and Border 2012 include children's asthma, diarrheal illness, exposure to pesticides, ambient air quality problems, and lack of infrastructure for public water supply and wastewater treatment. The report states that children living in poverty are more susceptible to environmental contamination because they are more likely to live in homes without safe running water and without proper sewage, to be exposed to dust from unpaved roads and agricultural activities, and to live near polluting industries, while at the same time being less likely to have proper nutrition and health care. Other children's health risks identified in the report were: indoor air quality of homes using wood and other biomass fuels for cooking and heating; surface- and groundwater contamination from human sewage and other contaminants; and lead poisoning from consumer products such as lead glazed pots. Children who live in special settings such as colonias (unincorporated communities), tribal land, and migrant labor camps may face particular environmental challenges. A copy of the Draft Seventh Report of the Good Neighbor Board may be obtained by contacting Arizona Department of Environmental Quality Border Program Manager, Placido Dos Santos, at dossantos.placido@ev.state.az.us, or by calling Mr. Dos Santos at (520) 628-6744.

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